

Contents

Preface and Acknowledgments	ix
A Student's Evening Hymn	xiii
Notation and Symbols	xvii
1 Introduction	1
2 Mechanistic and Dynamistic Traditions in Nineteenth-century Physics	6
Mechanistic and dynamistic approaches to science in general	9
Mechanistic and dynamistic attitudes in philosophy and the philosophy of science	20
The dynamistic syntheses of Hamilton and Whewell	27
Mechanistic and dynamistic attitudes in mathematical physics	31
Unification, analogy and mechanical models	45
3 Electromagnetism before Maxwell	52
Introduction	52
Oersted	55
Ampère	62
Faraday	72
Thomson	91
4 Maxwell's Apprenticeship: Analogy and Lines of Force	107
The young Maxwell	108
Mathematics of the magnetic field	121
Faraday's lines of force	133
Physical analogies	143

5 From Mechanical Lines to a Dynamical Field	156
Magnetism as molecular vortices	159
Idle wheels and electricity	169
Magneto-optics, electrostatics and the theory of light	176
Energy conservation and the rise of energy physics	191
A dynamical theory of the field	196
Energy physics and the role of mechanics	215
6 Maxwell's Maturity: <i>A Treatise on Electricity and Magnetism</i> and Other Writings	220
A simplified formulation of the theory of light	220
<i>A Treatise on Electricity and Magnetism</i>	226
Energy physics and vector analysis	234
Matter, charge and aether	245
The aims and methods of physical science	249
7 After Maxwell	255
Electromagnetic theory after Maxwell	256
Quantum and relativity theories	264
Maxwell's legacy: the aims and methods of modern physics	268
8 Conclusions	271
Appendix	278
Alternative Interpretations of Maxwell's Methodology: A Review of Further Reading	
Recollections of Dreamland	281
Bibliography	283
Index	300

